

U.S. DEPARTMENT OF COMMERCE  
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY  
(formerly National Bureau of Standards-NBS)  
OFFICE OF STANDARDS SERVICES

**COMMERCIAL STANDARD CS223-59**  
**CASTERS, WHEELS, AND GLIDES FOR HOSPITAL EQUIPMENT**

Commercial Standard CS223-59, Casters, Wheels, and Glides for Hospital Equipment, was withdrawn by the U.S. Department of Commerce on October 1, 1973.

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The Institute of Caster Manufacturers can provide guidance and assistance for information on their standards, requirements and/or other sources and copies (example: Guide to Understanding and Specifying Industrial Casters Industrial Wheels).

Contact: Institute of Caster Manufacturers (ICM), (formerly Caster and Floor Truck Manufacturers Association) 104 South Michigan Avenue, Suite 1500, Chicago, Illinois 60603, USA; Telephone: (312) 201-0101; Fax: (312) 201-0214.

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The following Federal Specification may be useful: FF-C-77C, Casters, Rigid and Swivel (Institutional Duty).

For additional information on GSA and Federal Specifications/Standards and how to obtain copies, contact: General Services Administration (GSA), Federal Supply Service, Specifications Branch, 470 East L'Enfant Plaza, SW, Suite 8100, Washington, DC 20407, USA; Telephone: (202) 619-8925; Fax: (202) 619-8978, Internet: <http://www.gsa.gov>

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The following organizations can provide assistance and information on their standards, requirements and specifications, other documents, publications, and/or copies (example: ASME B56.11.1, Double Race or Bi-Level Swivel and Rigid Industrial Casters). Contact: ASME International (was American Society of Mechanical Engineers-ASME), 3 Park Avenue, New York, New York 10016-5990, USA; Telephone: (212) 591-7722; Fax: (212) 591-7739; Internet: <http://www.asme.org>, American Hospital Association (AHA), 1 North Franklin, Suite 27, Chicago, Illinois 60606, USA; Telephone: (312) 422-3000; Fax: (312) 422-4519; Internet: <http://www.aha.org>.

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# **federal register**



**National Bureau of Standards**  
**CASTERS, WHEELS, AND GLIDES FOR**  
**HOSPITAL EQUIPMENT**

**Withdrawal of Commercial Standard**

In accordance with § 10.12 of the Department's "Procedures for the Development of Voluntary Product Standards" (15 CFR Part 10, as revised; 35 FR 8349 dated May 28, 1970), notice is hereby given of the withdrawal of Commercial Standard CS 223-59, "Casters, Wheels, and Glides for Hospital Equipment."

This action is taken in furtherance of the Department's announced intention, as set forth in the public notice appearing in the **FEDERAL REGISTER** of June 11, 1973 (38 FR 15378), to withdraw this standard.

The effective date for the withdrawal of this standard will be October 1, 1973. This withdrawal action terminates the authority to refer to this standard as a voluntary standard developed under the Department of Commerce procedures.

Dated: July 27, 1973.

**RICHARD W. ROBERTS,**  
*Director.*

[FR Doc.73-15865 Filed 7-31-73;8:45 am]

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## National Bureau of Standards CASTERS, WHEELS, AND GLIDES FOR HOSPITAL EQUIPMENT

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COMMERCIAL STANDARD **CS 223-59**

# **WITHDRAWN**

**Casters, Wheels, and Glides  
for Hospital Equipment**

A recorded  
voluntary standard of the  
trade published by  
the U.S. Department  
of Commerce



For sale by the Superintendent of Documents

U.S. Government Printing Office, Washington 25, D.C. Price 10 cents

**U.S. DEPARTMENT OF COMMERCE**

**LEWIS L. STRAUSS, Secretary**

Issued by

**OFFICE OF TECHNICAL SERVICES  
COMMODITY STANDARDS DIVISION**

**With the cooperation of  
NATIONAL BUREAU OF STANDARDS**

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**COMMERCIAL STANDARDS**

Commercial Standards are developed by manufacturers, distributors, and users in cooperation with the Commodity Standards Division of the Office of Technical Services, and with the National Bureau of Standards. Their purpose is to establish quality criteria, standard methods of test, rating, certification, and labeling of manufactured commodities, and to provide uniform bases for fair competition.

The adoption and use of a Commercial Standard is voluntary. However, when reference to a Commercial Standard is made in contracts, labels, invoices, or advertising literature, the provisions of the standard are enforceable through usual legal channels as a part of the sales contract.

Commercial Standards originate with the proponent industry. The sponsors may be manufacturers, distributors, or users of the specific product. One of these three elements of industry submits to the Commodity Standards Division the necessary data to be used as the basis for developing a standard of practice. The division, by means of assembled conferences or letter referenda, or both, assists the sponsor group in arriving at a tentative standard of practice and thereafter refers it to the other elements of the same industry for approval or for constructive criticism that will be helpful in making any necessary adjustments. The regular procedure of the division assures continuous servicing of each Commercial Standard through review and revision, whenever, in the opinion of the industry, changing conditions warrant such action.

**SIMPLIFIED PRACTICE RECOMMENDATIONS**

Under a similar procedure the Commodity Standards Division cooperates with industries in the establishment of Simplified Practice Recommendations. Their purpose is to eliminate avoidable waste through the establishment of standards of practice for sizes, dimensions, varieties, or other characteristics of specific products; to simplify packaging practices; and to establish simplified methods of performing specific tasks.

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The initial printing of CS 223-59 was made possible through the cooperation of the American Hospital Association.

# Casters, Wheels, and Glides for Hospital Equipment

[Effective June 15, 1959]

## 1. PURPOSE AND SCOPE

1.1 The purpose of this Commercial Standard is to establish standards for casters, wheels, and glides used on hospital equipment; to specify quality attributes, and interchangeability factors; and to embody the recommendations of manufacturers, distributors, and users in accordance with their composite experience. A further objective is to provide a simplified classification of types and constructions that are generally available from suppliers' stocks and are uniformly adapted to service requirements. The standard is also designed to serve as a guide for the application and replacement of the products covered in furnishing and servicing hospital equipment.

## 2. NOMENCLATURE AND DEFINITIONS

2.1 The following glossary includes certain terms as applied to casters by the trade:

**Adapter.**—That part which serves to attach or adapt the caster or glide to a chair, table, cabinet, or other equipment.

**Caster.**—A complete unit consisting of the caster assembly, axle, wheel, and wheel bearing.

**Caster assembly.**—A caster without the wheel and spanner bushing.

**Caster size.**—The nominal diameter of the wheel.

**Component thrust.**—Forces produced by a load in directions other than that in which the load is applied. For swivel casters, it is considered to be the forces on the secondary bearing in the swivel.

**Direct load.**—Force acting in the direction in which the load is applied. For swivel casters, it is considered to be the load sustained by the main bearing of the swivel.

**Direct thrust.**—See the term "direct load."

**Electrostatic conductivity.**—The ability of a material to transmit and dissipate electrostatic charges, such as those which may occur in vehicles or equipment on which casters are mounted.

**Exposed surface.**—A surface which is sufficiently exposed in the assembled unit to be subject to wear or corrosion, except that any exposed areas of bearing surfaces are excluded if protected by a lubricant.

**Finish.**—The treatment given exposed metal surfaces to protect them from corrosion, to

facilitate maintenance, and for good appearance.

**Horn assembly.**—A unit consisting of a horn plate (formerly termed the yoke or crown) and horn legs, which straddles the wheel and provides for attaching the axle to the caster.

**Impact load (shock).**—Instantaneous force produced when opposing objects move against or strike each other, such as a caster or wheel rolling over an obstruction or irregular surface.

**Kingpin.**—A part (generally a bolt or pin) which serves to maintain the proper relative positions of the parts of the caster swivel.

**Load rating.**—A nominal load generally recognized as an operational load for normal operating conditions, with a reasonable allowance for overload.

**Match.**—A term applied to a caster that is comparable in certain important respects with another of different type. The term is regularly applied to swivel and rigid casters of the same overall height, and having the same means for mounting.

**Mounting plate.**—A flat plate which provides for attaching the caster to the equipment by means of four bolts. (See pars. 3.1.4, 5.4, and 5.4.4, Adapter P.) A mounting plate may or may not include a kingpin.

**Offset.**—The horizontal distance between the centerlines of the kingpin or swivel bearing and the axle of a caster, as mounted for normal use.

**Overall height.**—The vertical distance between the bottom of the caster wheel and the surface on which the equipment normally rests. In effect, it is the vertical distance between floor and the base of the equipment supported by the caster.

**Rolling load.**—The load on a caster or wheel when the equipment it supports is in motion.

**Secondary load.**—The forces sustained by the secondary or thrust bearing of the caster swivel.

**Spanner bushing.**—A sleeve through which the axle passes, and which forms the inner or non-rotating member of the bearing on which the wheel revolves.

**Spark proof (non-sparking).**—Material that will withstand friction or abrasion without sparking.

*Static load.*—The load on a caster or wheel when the equipment it supports is not in motion.

*Stem.*—That part of the caster assembly that extends upward into the equipment, and also forms the central part of the adapter for its attachment to the equipment. (See pars. 3.1.4 and 5.4, Adapters A, K, N, and T.)

*Swivel radius.*—The horizontal distance between the centerline of the kingpin or swivel bearing and the most distant point on the wheel tread. It is also considered to be the radial clearance that permits a caster to swivel 360° without obstruction.

*Tread width.*—The width of the tread or tire of a wheel, as taken at the base (not face) of the tread, excluding any extensions for holding it in place.

### 3. CASTERS

#### 3.1 Classifications.

3.1.1 *Classes.*—Casters shall be of the following classes: (See par. 3.1.2, Table 1.)

Class F—Light duty.<sup>1</sup>

Class E—Light-medium duty.<sup>1</sup>

Class D—Medium duty.<sup>1</sup>

Class C—Medium-heavy duty.<sup>2</sup>

3.1.2 *Sizes and classes.*—The sizes and classes of casters, and corresponding forms of adapters, wheel styles, and tread dimensions shall be as shown in Tables 1 and 2.

3.1.3 *Wheel styles.*—Wheels in casters shall be of the following styles: (See table 1 and par. 5.18.)

Style 1—Rubber wheel (soft rubber tread on hard rubber core).

Style 2—Composition (hard rubber tread on hard composition core).

Style 3—Disc wheel (soft rubber tread, demountable; steel disc wheel).

3.1.4 *Adapters.*—Adapters for attaching casters to the equipment shall be of the following forms: (See Table 2 and par. 5.4.)

Adapter A—Expanding adjustable adapter for stem.

Adapter K—Formed socket for stem.

Adapter N—Spring core for stem.

Adapter P—Mounting plate.

Adapter T—Threaded stem.

3.1.5 *Electrostatically conductive casters.*—When specified or otherwise required, the casters shall be electrostatically conductive. (See pars. 5.20, 5.23 and 9.2.1.)

<sup>1</sup> Classes F, E, and D casters are intended for slow manual operation under service conditions normal to general use in hospitals. Swivel casters are equipped with swivel bearings of commercial ball or roller type.

<sup>2</sup> Class C casters are intended for manual operation (2½ to 3 miles per hour) under service conditions normal to hospital facilities for materials handling. Swivel casters are equipped with swivel bearings of commercial ball or roller type.

3.1.6 *Finishes.*—Finishes for exposed metal parts of casters shall be provided as follows: (See pars. 5.22 and 9.2.1)

(a) For Class F, light duty casters:

(1) Finishes for iron and steel:

Finish F1—Oxidized copper or other suitable oxide.

Finish F2—Cadmium or zinc plated.

Finish F3—Nickel plated.

(b) For Class E, Class D, and Class C casters:

(1) Finishes for iron and steel:

Finish F2—Cadmium or zinc plated.

Finish F4—Colored lacquer or enamel.

(2) Finishes for aluminum:

Finish F5—Anodic oxide coating.

Finish F6—Clear lacquer.

### 4. WHEELS

4.1 *WHEELS.*—(Not furnished in casters.)

4.1.1 *Classes, diameters, styles, and finishes.*—Classes, diameters, and axle sizes for wheels not furnished in casters are given in table 3. Styles shall be as given in paragraph 3.1.3. Standard finishes shall be as given in paragraph 3.1.6. (See par. 9.2.2 for the list of information that should be given in purchase orders or specifications for wheels.)

4.1.2 *Construction.*—Wheels shall have ball or roller bearings, and shall conform to all applicable requirements in Section 5 and applicable tests in Section 7. (See pars. 5.1, 5.2, 5.3, 5.7.1, 5.9, 5.10, 5.14, 5.15, 5.18 to 5.24, 7.1, 7.2, 7.4, and 7.5 to 7.7.)

4.1.2.1 Under loads equal to the applicable load ratings specified in table 5, the wheels shall rotate freely. After being subjected to the load test specified in 7.4, wheels shall not be deformed or damaged and shall rotate freely, except that a slight deformation of soft rubber treads will be acceptable, provided they meet this standard in all other respects. When electrostatically conductive wheels are specified they shall conform to the requirements of paragraph 5.20.

### 5. REQUIREMENTS

5.1 *MATERIAL, GENERAL.*—Material shall be in accordance with all applicable requirements given herein. Where no applicable requirements are given, the material shall be suitable for the purpose and be utilized in accordance with good commercial practice. All material shall be free from defects and imperfections that might affect the serviceability of the finished product.

5.2 *STANDARD PRODUCT.*—The finished unit and each of its component parts shall be a standard cataloged product of a manufacturer, and one that is available for prompt and continuing service and delivery of spare parts. The component parts of the unit need not be the product of the manufacturer of the unit.



TABLE 1. Casters—sizes, classes, wheel styles, and adapters <sup>1</sup>

Caster size <sup>2</sup>	Class and duty	Forms of adapters <sup>3</sup>				Wheel styles <sup>4</sup>	
		Stem models Adapters A, K, N, T		Plate models Adapter P		Styles 1 and 2	Style 3 <sup>4</sup>
		Swivel type	Rigid type	Swivel type	Rigid type		
<i>Inches</i> 2 3 5	Class F (light duty)	<sup>5</sup> X <sup>6</sup> X <sup>6</sup> X	----- X X	<sup>6</sup> X <sup>6</sup> X <sup>6</sup> X	----- X X	X X X	----- X X
5 6 8 10	Class E (light-medium duty)	<sup>6</sup> X <sup>6</sup> X <sup>6</sup> X <sup>6</sup> X	X X X X	X X X X	X X X X	X X X X	X X X X
5 6 8	Class D (medium duty)	X X X	X X X	X X X	X X X	X X X	X X X
5 6 8	Class C (medium-heavy duty)	----- ----- -----	----- ----- -----	<sup>6</sup> X <sup>6</sup> X <sup>6</sup> X	X X X	X X X	----- X X

<sup>1</sup> See par. 9.2.1 for list of information that should be given in purchase orders or specifications for casters. For additional information on wheel styles, adapters, finishes, and electrostatically conductive casters, see table 2 and pars. 3.1.3 to 3.1.6.

<sup>2</sup> Nominal wheel diameter. See par. 5.3 regarding wheel diameters of matching swivel and rigid casters.

<sup>3</sup> Adapters and styles of wheels are provided as indicated by X. See pars. 3.1.3 and 3.1.4.

<sup>4</sup> Style 3 wheels are not furnished in the 2-in. size Class F; nor in the 5-in. size, Class C; 10-in. wheels are Style 3 only. However, certain casters with non-standard wheels may be available as specials.

<sup>5</sup> Caster is furnished with wheel brake when specified. See par. 5.12.

<sup>6</sup> Caster is furnished with swivel lock when specified. See par. 5.13.

TABLE 2. Casters—sizes, classes, and tread dimensions

Caster size <sup>1</sup>	Class and duty	Tread width, minimum <sup>2</sup>		Nominal thickness of soft tread <sup>3</sup>	
		Wheel styles 1 and 2	Wheel style 3	Wheel style 1	Wheel style 3
<i>Inches</i> 2 3 5	Class F (light duty)	<i>Inches</i> $\frac{3}{4}$ $\frac{13}{16}$ $\frac{15}{16}$	<i>Inches</i> ----- $\frac{7}{8}$ $\frac{7}{8}$	$\frac{1}{4}$ $\frac{9}{16}$ $\frac{1}{2}$	----- $\frac{9}{32}$ $\frac{3}{8}$
5 6 8 10	Class E (light-medium duty)	$1\frac{1}{8}$ $1\frac{1}{2}$ $1\frac{1}{2}$ -----	$1\frac{1}{8}$ $1\frac{1}{2}$ $1\frac{1}{2}$ $1\frac{1}{2}$	$\frac{1}{2}$ $\frac{9}{16}$ $\frac{5}{8}$ -----	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$
5 6 8	Class D (medium duty)	$1\frac{1}{2}$ $1\frac{1}{2}$ $1\frac{1}{2}$	$1\frac{1}{2}$ $1\frac{1}{2}$ $1\frac{1}{2}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{5}{8}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$
5 6 8	Class C (medium-heavy duty)	2 2 2	----- $1\frac{13}{16}$ $1\frac{15}{16}$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{3}{4}$	----- $\frac{1}{4}$ $\frac{3}{4}$

<sup>1</sup> Nominal wheel diameter. See par. 5.3 regarding wheel diameters of matching swivel and rigid casters.

<sup>2</sup> See pars. 7.5.7 and 7.5.8 for method of determining thickness and width of soft tread.

**5.3 SIZE AND TYPE.**—The size of a caster shall be the nominal diameter of the wheel in inches. Rigid type casters shall have a rigid connection between the horn and the stem or mounting plate in place of a swivel. Unless otherwise specified, swivel and rigid types of casters made by the

same manufacturer, and of the same class, size, and mounting shall match each other fully in overall height and form of adapter. The match in overall height may be secured by the use of a wheel in the rigid caster that is larger in diameter than the wheel in the swivel caster.

TABLE 3. *Wheels—diameters and classes*<sup>1</sup>

Nominal wheel diameter	Class and duty	Wheel styles	Bore (to fit axle size)
<i>Inches</i> 10	Class E (light-medium)	3	<i>Inch</i> $\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{5}{16}$
5 8	Class D (medium)	1, 2, 3 1, 2, 3	$\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{5}{16}$ $\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{5}{16}$
5 6 8	Class C (medium-heavy)	1, 2, 3 1, 2, 3 1, 2, 3	$\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{5}{16}$ $\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{5}{16}$ $\frac{3}{8}$ , $\frac{1}{2}$ , $\frac{5}{16}$

<sup>1</sup> See tables 1 and 5 for tread width and load ratings.

5.4 ADAPTERS.—Adapters shall be of steel, except as otherwise provided herein for parts of Adapters A, K, N, and P. Adapters shall be of proper size for attaching the caster securely to the equipment for which they are intended.

5.4.1. *Adapter A. Expanding adjustable adapter for stem.*—Stem shall be round and have either metal or rubber expansion members, at the option of the manufacturer.

5.4.1.1 *Metal expansion adapter.*—The adapter shall consist of a threaded stem with hexagon adjusting nut and metal expanding members that engage the inside wall of tubing when properly applied. When properly expanded by the nut, the adapter shall withstand an extractive force of 50 pounds. (See extraction test, par. 7.3.1.)

5.4.1.2 *Rubber expansion adapter.*—The adapter shall consist of a threaded stem with a hexagon adjusting nut and one or more rubber expanding members. The expanding member or members shall be not less than  $1\frac{1}{2}$  inches in total length before expansion and shall provide a contact area not less than  $\frac{1}{4}$  inch in length at the top and at the bottom of the adapter. When properly expanded by the nut, the adapter shall withstand an extractive force of 50 pounds. (See extraction test, par. 7.3.1.) The rubber expanding members shall be of such composition that they will not become brittle or show evidence of cracking or tackiness upon inspection by visual examination and handling, after being subjected to the oxygen bomb test. (See par. 7.5.2.2.)

5.4.2 *Adapter K. Formed socket for stem.*—The adapter shall consist of a stem and a socket formed to receive the stem. The socket shall also provide for its permanent attachment to metal legs of the equipment by suitable means, such as a drive fit or welding, or by other means as specified. A spring retainer shall be included in either the stem or the socket. It shall permit removal of the caster when desired, and also hold it in place at all times so as to withstand an extractive force of 5 pounds. (See extraction test, par.

7.3.2.) The spring retainer shall be made of a separate piece of spring steel or bronze. The socket and stem shall be either cadmium or zinc plated.

5.4.3 *Adapter N. Spring-core for stem.*—The spring-core adapter shall consist of a stem, a cast iron or aluminum alloy core having a suitable flange at its lower end to carry the load, and a heavy flat steel spring shaped to fit tightly into the tubing. The core when properly applied shall withstand an extractive force of 10 pounds (see extraction test, par. 7.3.1), and shall be suitably treated to resist corrosion. If the stem is not permanently attached to the core, it shall include a spring retainer which shall permit removal of the caster from the core and also provide for holding the stem in place at all times so as to withstand an extractive force of 5 pounds. (See extraction test, par. 7.3.2.) The retainer shall be of a separate piece of spring steel or bronze.

5.4.4 *Adapter P. Mounting plate.*—The adapter plate shall be of steel, malleable iron, or suitable aluminum alloy with four bolt holes. Any of the applicable standard bolt hole spacings given in table 4 may be furnished at the option of the supplier, unless otherwise specified to suit a particular condition or special construction. However, the spacings furnished by any one manufacturer shall be uniform for each size and class, and

TABLE 4.—*Standard bolt-hole spacings*

Caster size	Class	Adapter P standard bolt-hole spacings
<i>Inches</i> 2 3, 5 5, 6, 8 5, 6, 8 5, 6, 8	F F E D <sup>1</sup> C	<i>Inches</i> $1\frac{1}{8} \times 1\frac{1}{8}$ ; $1\frac{1}{8} \times 1\frac{1}{8}$ ; $1 \times 2\frac{1}{4}$ . $1 \times 2\frac{1}{4}$ ; $1\frac{1}{8} \times 2\frac{1}{4}$ ; $1\frac{1}{8} \times 3$ . $1\frac{1}{8} \times 2\frac{1}{4}$ ; $2\frac{1}{8} \times 3\frac{1}{8}$ ; $2\frac{1}{8} \times 3\frac{1}{8}$ . $2\frac{1}{8} \times 3\frac{1}{8}$ ; $3 \times 3$ ; $3\frac{1}{8} \times 5\frac{1}{8}$ . $3\frac{1}{8} \times 5\frac{1}{8}$ ; $4\frac{1}{8} \times 4\frac{1}{8}$ ; $3 \times 6$ .

<sup>1</sup> Class D casters may have bolt holes spaced  $3 \times 6$  in., in addition to the spacings tabulated.

the mounting plates for swivel and rigid casters of corresponding sizes and classes shall fully match.

5.4.5 *Adapter T. Threaded stem.*—The adapter shall consist of a stem and a nut securely affixed to the stem. The nut shall be not less than 0.180-inch thick ( $\frac{3}{16}$ -inch approximate thickness) and be  $1\frac{3}{4}$  inches or 2 inches across the flats, as applicable. The stem shall project  $1\frac{1}{8}$  inches above the nut and be threaded for a length of 1 inch at its upper end with a  $\frac{5}{8}$ -inch diameter 11-pitch National coarse thread, class 2 fit ( $\frac{5}{8}$ -inch—11NC-2).

5.5 *HORN ASSEMBLY.*—The horn assembly shall be either of steel, malleable iron, or suitable aluminum alloy, and be of such thickness and form that it will provide sufficient strength and rigidity to meet the requirements specified herein. Casters shall have well formed horn assemblies having a neat appearance.

5.6 *AXLE.*—Axle shall be of cold-drawn steel and be of the bolt and nut type. The axle design and assembly shall be such that the axle will not revolve and the nut will not become loosened under normal working conditions. The method of assembly shall also prevent the clamping of the wheel between the legs of the horn when the nut on the axle bolt is drawn up tight.

5.7 *WHEEL BEARINGS.*—Style 1 and 2 wheels in Class F casters shall have self-lubricating bearings. All other wheels shall have ball and/or roller bearings, unless otherwise specified. (See par. 5.7.2.2.)

5.7.1 *Races for ball and roller bearings in wheels.*—The outer races of wheel bearings, if of one-piece design, shall be fully case-hardened to a depth of not less than 0.005 inch; if of a two-piece (split) design, the races shall be of A.I.S.I. type C 1050 planished and mill-hardened steel. The inner race of wheel bearings shall be fully case-hardened to a depth of not less than 0.005 inch. For roller bearings, the inner race shall be a part of, or fitted on, a full length steel sleeve through which the axle is inserted. For ball bearings, the races shall provide curvilinear contact with the balls and the inner races shall butt at a central point so as to provide the equivalent of a full length sleeve, or provide other equivalent means of avoiding preloading and binding of the bearing members when the axle nut is drawn up tight. The inner races shall not revolve with the wheel.

5.7.2 *Self-lubricating wheel bearings.*—Under ordinary operating conditions, self-lubricating bearings shall not be affected by heat and shall not work loose.

5.7.2.1 For Styles 1 and 2 wheels in Class F casters, self-lubricating bearings shall be of molded sintered porous bronze or iron, impregnated with lubricating oil, except that for phenolic composition wheels, self-lubricating bearings shall have a graphite impregnated hub.

5.7.2.2 For Class E, D, and C casters and for Style 3 wheels in Class F casters, self-lubricating bearings shall be furnished only when specified. When furnished, they shall be of molded and sintered porous bronze or iron, impregnated with lubricating oil.

5.8 *SWIVEL BEARINGS.*—Caster swivel shall have bearings of ball or roller type. In swiveling under load, all forces (direct and component thrusts, also referred to as main and secondary loads) shall be effectively transmitted through the ball or roller bearings in contact with their respective raceways.

5.8.1 *Races in swivel bearings.*—The races in swivel bearings shall provide curvilinear contact with balls and linear contact with rollers according to the type of bearing. The races shall be fully case-hardened to a depth of not less than 0.005 inch for Class F, E, D Casters, and not less than 0.010 inch for Class C casters. The races shall be either ground smooth or die-formed and coined.

5.9 *BALLS AND ROLLERS.*—The balls and rollers of wheel bearings and swivel bearings shall be of hardened steel and shall be ground and polished. The difference between any two diameters of the same ball or roller shall not exceed 0.001 inch. The difference between the diameters of any two balls or rollers in the same bearing unit shall not exceed 0.002 inch.

5.10 *HARDNESS VALUE OF BEARING SURFACES.*—Case-hardened bearing surfaces specified under paragraphs 5.7.1, 5.8.1, and 5.9 shall be file hard (fully case-hardened) to the required depth where stated, so as to provide effective resistance to ball or roller failure and to penetration of the raceway surfaces. For Class F, E, and D casters, the hardened bearing surfaces shall test not less than 15N90 Rockwell hardness. For Class C casters the hardened bearing surfaces shall test not less than 45N60 Rockwell hardness.

5.11 *KINGPIN IN SWIVEL BEARINGS.*—The kingpin shall be of steel and be secured in place so that in swiveling it will not be in frictional contact with any member of the swivel bearing assembly. The kingpin shall be of such design, construction, and material that it will maintain effectively the proper relative position of swivel bearing components for the life of the caster under normal operating conditions.

5.12 *BRAKES FOR WHEELS.*—When so specified for certain swivel casters as designated in table 1, they shall be furnished with a wheel brake. The braking action shall be produced by the pressure of a plate and/or the side of the horn applied against the hub of the wheel, against the side of the tire, or against the full face of the tread.

5.13 *SWIVEL LOCK.*—When so specified for Class C swivel casters with mounting plate, Adapter P, a swivel lock shall be furnished. The lock shall hold the caster rigidly in position so that it will not swivel. The lock may be of either the

TABLE 5.—Load ratings for casters <sup>1</sup>

Caster size (nominal wheel diam.)	Class and duty	Styles 1 and 2 wheels			Style 3 wheels	
		Tread width minimum	Load ratings		Tread width minimum	Load ratings, style 3
			Style 1	Style 2		
<i>Inches</i>		<i>Inches</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Inches</i>	<i>Pounds</i>
2	Class F (light duty)	$\frac{3}{4}$	75	100	-----	-----
3		$1\frac{1}{16}$	100	125	$\frac{7}{8}$	100
5		$1\frac{1}{8}$	125	145	$\frac{7}{8}$	125
5	Class E (light-medium duty)	$1\frac{1}{8}$	160	245	$1\frac{1}{8}$	200
6		$1\frac{1}{8}$	190	280	$1\frac{1}{8}$	250
8		$1\frac{1}{8}$	220	335	$1\frac{1}{8}$	300
10		-----	-----	-----	$1\frac{1}{8}$	300
5	Class D (medium duty)	$1\frac{1}{2}$	240	350	$1\frac{1}{2}$	300
6		$1\frac{1}{2}$	280	400	$1\frac{1}{2}$	400
8		$1\frac{1}{2}$	325	450	$1\frac{1}{2}$	500
5	Class C (medium-heavy duty)	2	325	450	-----	-----
6		2	400	560	$1\frac{1}{16}$	500
8		2	475	600	$1\frac{1}{16}$	600

<sup>1</sup> See par. 5.15.

1-position or 4-position type, unless otherwise specified.

5.14 **THREAD GUARD.**—When specified, Class F, E, D, and C casters of sizes 3-inch and 5-inch shall be furnished with suitable thread guards.

5.15 **LOAD RATING.**—The load ratings given in Table 5 shall be applicable to casters having wheels of the nominal diameters and minimum tread widths shown, and which otherwise conform to this standard. (See pars. 9.1.1 and 7.5.8.)

5.16 **OPERATION.**—Under no load, the caster wheel shall roll freely and the horn of swivel casters shall swivel freely. There shall be no indication of binding in the casters, or of looseness in excess of that necessary to avoid binding.

5.17 **STRENGTH.**—When tested in accordance with paragraph 7.4 the casters shall not be deformed or damaged, except that a slight deformation of soft rubber treads will be acceptable, provided they meet this standard in all other respects.

5.18 **WHEELS.**—Caster wheels shall be in accordance with tables 2 and 3, and shall conform to applicable requirements given below. The greatest width of the wheel shall be at the hub.

5.18.1 **Style 1 wheels.**—Style 1 wheels shall have a soft rubber tread securely vulcanized to a hard rubber core or tread base. The tread shall conform to paragraph 5.19. The core shall be of a composition having compressive, flexural, and impact strength adequate for the purpose intended, and a hardness of 70 to 85 when measured as described in paragraph 7.5.1.

5.18.2 **Style 2 wheels.**—Style 2 wheels shall be of hard rubber or other suitable composition and be integrally molded. The tread and core shall have compressive, flexural, and impact strength adequate for the purpose intended and

shall be resistant to the destructive action of water, mild acids, and ordinary floor cleaning compounds. The hardness throughout shall be 75 to 85 when measured as described in paragraph 7.5.1.

5.18.3 **Style 3 wheels.**—Style 3 wheels shall have a soft rubber tread mounted on two steel discs. The assembly shall be firmly held in place with flanges and screws so that the tread is demountable and replaceable. The tread shall conform to paragraph 5.19. (Not furnished in 2-in. size, see table 1.)

5.19 **RUBBER, SOFT TREAD.**—The tread shall consist of synthetic or natural rubber or any combination thereof, provided it meets the requirements given below.

5.19.1 **Hardness of soft tread.**—The face of the soft rubber tread on Style 1 and Style 3 wheels, as received, including electrostatically conductive rubber, shall have a durometer hardness of 70 to 85 for Style 1 and 70 to 80 for Style 3, when measured as described in paragraph 7.5.1. After being subjected to the air-oven process described in paragraph 7.5.2.1, the hardness shall not change more than 10 units.

5.19.2 **Elongation.**—The elongation of soft rubber treads on Style 1 and Style 3 wheels, as received, shall be not less than 250 percent. After being subjected to the air-oven process described in paragraph 7.5.2.1, the decrease in elongation shall not exceed 25 percent (see par. 7.5.4).

5.19.3 **Tensile strength.**—The tensile strength of the soft rubber tread, as received, shall be not less than 1000 pounds per square inch for Style 1 and 2000 pounds for Style 3. After being subjected to the air-oven process described in paragraph 7.5.2.1, the decrease in tensile strength shall not exceed 25 percent (see par. 7.5.3).

5.19.4 *Compression set.*—The compression set under a deflection of 25 percent of the original thickness of the test specimen shall be not more than 50 percent (see par. 7.5.5). Under the test described in paragraph 7.5.5.1, any apparently permanent set in the soft rubber tread shall recover completely in 10 revolutions of the wheel.

5.19.5 *Adhesion.*—The force necessary to separate the soft tread from its base or wheel rim in Style 1 and Style 3 wheels shall be not less than 50 pounds per inch of tread width at the base of the tread, when tested in accordance with paragraph 7.5.6. Upon examination at the conclusion of the test, the material pulled off and that remaining on the core shall show no indication of blistering or porosity.

5.20 *ELECTROSTATICALLY CONDUCTIVE CASTERS, SEPARATE WHEELS, AND GLIDES.*—The casters, separate wheels, and glides shall provide a positive electrical contact with the equipment they support. The wheel treads and cores, and glide cushions, shall be of such material and construction that, when the caster, separate wheel, or glide is subjected to the test described in paragraph 7.6, the average electrical resistance shall be less than 250,000 ohms and the maximum of individual electrical resistance readings shall be less than 1,000,000 ohms. (See par. 5.23.)

5.21 *LUBRICATION.*—Ball and roller bearings in wheels and swivel bearings shall be adequately lubricated when assembled, and shall be mounted so that they can be effectively lubricated by a normal maintenance procedure. Ball and roller bearings in wheels for all classes of casters, and in separate wheels, and in swivel bearings for Class C casters, shall have either pressure-type lubrication fittings or other suitable provision for placing lubricant in the bearing housing by a normal maintenance procedure.

5.22 *FINISHES.*—(See also par. 3.1.6.)

5.22.1 *Nickel plating on iron and steel.*—The nickel shall be applied either directly or over a coating of copper, and may be either with or without a final coating of chromium. On exposed surfaces, the thickness of the nickel coating, or of the combined layers of copper, nickel and chromium, shall be at least 0.0004 inch, and when copper is used as a base, the thickness of the final layer of nickel and chromium shall be at least 0.0002 inch. The exposed plated surfaces shall show no appreciable corrosion at the end of 16 hours continuous exposure in the salt spray test (see pars. 7.7.1 and 7.7.2).

5.22.2 *Cadmium or zinc plating on iron or steel.*—On exposed surfaces the minimum thickness of cadmium shall be 0.0003 inch. A zinc coating having a minimum thickness of 0.0005 inch may be furnished in lieu of cadmium (see par. 7.7.1).

5.23 *MARKING.*—The manufacturer's name or a readily identified trade-mark shall be plainly and permanently marked on each caster and on each separate wheel. *Electrostatically conductive*

wheels and glides shall be plainly and permanently marked on each side with the word *conductive*, or shall have marbelized coloring or other very noticeable marking characteristics that give a positive identification which cannot be confused with standard wheels or glides.

5.24 *WORKMANSHIP.*—All exposed metal surfaces of casters, separate wheels, and glides, shall be clean and smooth, and be finished in a workmanlike manner, without rough edges or sharp projections. The workmanship throughout shall be in accordance with good commercial practices.

## 6. GLIDES, RUBBER CUSHION

6.1 *CONSTRUCTION, GENERAL.*—Glides shall have a steel base, a rubber cushion, and an adapter for attachment to the equipment. (See par. 9.2.3 for list of information that should be given in purchase orders or specifications for glides.) When attached, there shall be no metal-to-metal contact between the base and the adapter. All glides shall conform to paragraph 5.24, workmanship.

6.1.1 *Base construction.*—The base shall be of steel not less than 0.035 inch thick, with substantially flat bottom, and with sides properly formed and curved to hold the rubber cushion. The base shall be of either carbon steel or stainless steel unless stainless steel is specified. Stainless steel shall be of either Type 302 (18-8 percent chromium-nickel composition) or Type 430 (16 to 18 percent straight chromium steel). The base of carbon steel glides shall be file hard (fully case-hardened) to a minimum depth of 0.005 inch, and the hardened surface shall test not less than 15N90 Rockwell hardness.

6.1.2 *Cushion construction.*—The cushion shall be of a suitable grade of nonblooming soft black rubber having a durometer hardness of 60 to 80 when measured as described in paragraph 7.5.1. The cushion shall not become brittle, nor show evidence of cracking or tackiness upon inspection by visual examination and handling after being subjected to the oxygen bomb test (see par. 7.5.2.2.). The cushion shall be correctly formed to fit snugly and fill the inside of the metal base, and shall extend above the top edge of the base approximately  $\frac{3}{16}$  inch for proper cushioning effect.

6.2 *SIZES OF GLIDES.*—The size of a glide shall be the nominal outside diameter of the base in inches. The following sizes of glides are standard for hospital equipment:  $\frac{7}{8}$ ,  $1\frac{1}{16}$ ,  $1\frac{1}{4}$ , and  $1\frac{1}{2}$  inches.

6.3 *ADAPTERS FOR GLIDES.*—Adapters for attaching rubber cushion glides to the equipment shall be of the following forms:

(a) *Nail adapter for wood.*—The nail shall be not less than No. 14 wire gage (0.083 in. diam.). It shall project approximately  $\frac{5}{8}$  inch out from the top of the

cushion and shall have a standard needlepoint nail tip.

- (b) *Stem and gripneck socket adapter for wood; for 1¼ and 1½ inch glides.*—The steel socket adapter shall fit properly into a bore ¾ inch in diameter and 1½ inches deep, and shall have a toothed track plate ¾ inch in diameter.
- (c) *Machine screw for metal.*—The screw shall be a standard No. 8-32 machine screw, which shall project approximately ¾ inch out from the top of the cushion, and shall be equipped with suitable nuts and lockwashers.
- (d) *Spring adapter for metal tubing.*—The adapter shall consist of a steel spring member with leg washer or mount, as needed, and have a stem or other means for securely attaching the steel spring adapter and leg washer or mount to the cushion and base assembly. The adapter shall fit tubing of the inside dimensions specified.
- (e) *Umbrella adapter for metal tubing.*—The adapter shall be as described in the preceding paragraph (d), except that the steel spring member shall be substantially umbrella-shaped and constructed so that the glide can be easily applied to the tubing by hand, with a light hammer blow, but cannot be removed except with suitable tools. The adapter shall fit tubing of the inside dimensions specified.
- (f) *Expansion adapter for metal tubing.*—The adapter shall be suitable for attachment to a hollow metal tube or through a round hole in a plate, as required. A rubber expanding adapter shall be used for tube, and a rubber expanding rivet for the hole in a plate. The hole shall be ⅝ inch in diameter. When required for tubing, the adapter shall fit tubing of the inside dimensions specified.

**6.4 FINISHES FOR GLIDES.**—Finishes for the steel bases shall be provided as shown below. Metal parts other than bases shall be cadmium or zinc plated. Plated finishes shall meet the applicable requirements in paragraph 5.22.

Carbon steel: F1—Oxidized copper finish.  
F3—Nickel plated finish.

Stainless steel: F7—Natural polished finish.

**6.5 ELECTROSTATICALLY CONDUCTIVE GLIDES.**—When specified or otherwise required, the glides shall be electrostatically conductive. (See par. 5.20 and 5.23.)

## **7. SAMPLING, INSPECTION, AND TEST PROCEDURES**

**7.1 INSPECTION AND TEST, GENERAL.**—Inspection and tests shall be made by the manufacturer

as needed to determine that the finished casters, wheels, and glides conform to the applicable requirements of this standard, except that tests for electrostatic conductivity shall be made during manufacture in accordance with paragraph 7.6.2. Inspection and tests may also be made independently by the purchaser, but when required, inspection by the purchaser at the place of manufacture shall be allowed. (See par. 7.2.)

**7.2 SAMPLING AND INSPECTION BY THE PURCHASER.**—(See par. 7.1.)

**7.2.1 Sampling by the Purchaser.**—Samples of any materials, components, etc., other than any furnished by the purchaser, which enter into the manufacture of the products to which this standard applies, may be selected as required by the purchaser or his inspector for inspection and test to determine conformity with this standard.

**7.2.2 Inspection by the Purchaser.**—Inspection may be made by the purchaser throughout the entire process of manufacture. The passing as satisfactory of any detail of construction or material shall not relieve the manufacturer of his responsibility for faulty workmanship or material which may be discovered at any time prior to final acceptance. Final inspection of the finished articles shall be made either at the point of production or at the point of delivery, as specified. For factory inspection, every reasonable facility shall be afforded inspectors by the manufacturer for the prosecution of their work.

**7.3 EXTRACTION TESTS FOR ADAPTERS.**

**7.3.1 Test for Adapters A and N.**—The Adapter A assembly shall be inserted into a tube of the size and type for which it is intended and be expanded in the customary manner without overstraining any of the parts, after which, the required extractive force shall be applied for a period of 1 minute. The Adapter N assembly shall be repeatedly inserted into a tube of the size and type for which it is intended and then be pulled out for a total of 10 insertions and 10 extractions. After the last extraction, the adapter shall be reinserted and the required extractive force applied without impact by means of weights for a period of 1 minute.

**7.3.2 Test for stem retainers, Adapters K and V.**—Adapters employing a spring retainer for holding the caster by its stem shall be tested as follows: Insert the stem into the adapter and pull it out repeatedly for a total of 10 insertions and 10 extractions. After the last extraction, the stem shall be reinserted and the required extractive force applied for a period of 1 minute.

**7.4 TEST FOR STRENGTH UNDER LOAD.**—A compressive load equal to four times the load rating of the caster given in Table 5, shall be applied without impact by weights or by a testing machine for a period of 1 minute. Upon removal of the test load, the caster shall be inspected for compliance with the requirements of paragraphs 4.1.2.1 and 5.17.



## 7.5 TESTS FOR RUBBER TREAD.

7.5.1 *Durometer hardness.*—The durometer hardness of soft rubber treads shall be determined in accordance with Federal Standard 601, Method 3021. The durometer hardness of hard rubber treads shall be determined by a Type D Shore durometer. Unless otherwise specified, hardness shall be taken as instantaneous durometer readings at 70° F.

### 7.5.2 *Accelerated aging.*

7.5.2.1 *Air-oven process.*—Test specimens shall be aged for 168 hours at 70° C. (158° F.) under the air-oven process described in Federal Standard 601, Method 7221 or 7231.

7.5.2.2 *Oxygen bomb process.*—Test specimens shall be aged for 168 hours at 70° C. (158° F.) in oxygen at 300 plus or minus 10 pounds per square inch pressure under the process described in Federal Standard 601, Method 7111.

7.5.3 *Tensile strength.*—The tensile strength shall be determined in accordance with Federal Standard 601, Method 4111, using die No. VI.

7.5.4 *Ultimate elongation.*—The ultimate elongation shall be determined in accordance with Federal Standard 601, Method 4121, using die VI of Method 4111.

7.5.5 *Compression set.*—The compression set shall be determined in accordance with Federal Standard 601, Method 3311, except that for Class E, Class D, and Class C casters, the thickness of the specimen shall be 0.502 inch minimum to 0.505 inch maximum, and for Class F casters, 0.252 inch minimum to 0.255 inch maximum. As certain tread widths are not sufficient to produce a full circular specimen, the best obtainable specimens shall be used for this test.

7.5.5.1 The caster or wheel to be tested shall be maintained for 24 hours at 70° F. while supporting a load equal to the load rating given in Table 5 and shall not be moved during this period of loading. At the end of the 24-hour period, the wheel shall be moved sufficiently to reveal any permanent set in the tread. If any deformation is apparent, the wheel shall be rolled 10 revolutions under the load and the tread shall be examined for recovery, as required in paragraph 5.19.4. (Note.—The rolling test may be continued to determine conformity with par. 4.1.2.1.)

7.5.6 *Test for adhesion.*—The tread shall be cut transversely down to its base. It may be trimmed down to the base along the flanges to minimize tearing of the tread. With the wheel supported horizontally on free rotating bearings in a suitable fixture, the tread shall be separated circumferentially from the base, as by means of a suitable testing machine exerting a radial pull, at the rate of approximately 6 inches per minute. The minimum force necessary to separate the tread from the base shall be measured to determine compliance with paragraph 5.19.5.

7.5.7 *Method of determining thickness of soft tread.*—The tread thickness shall be determined

at four points equally spaced around the wheel and shall be measured at the center of the tread. At least two of the measurements shall equal or exceed the nominal thickness given in Table 2, and no measurement shall be less than 65 percent of the nominal thickness.

7.5.7.1 Measurements of tread thickness and width shall include only that portion of the tread which may be subject to wear in regular use.

7.5.8 *Method of determining width of tread.*—Tread with parallel sides shall be measured so as to determine the width at its base (see par. 7.5.7.1). If the sides are rounded or tapered, the width at a point midway between the face and the base may be less than the width at the base by an amount not greater than  $\frac{1}{4}$  the nominal tread thickness. (See Table 2.)

7.6 TEST FOR ELECTROSTATIC CONDUCTIVITY.—The surface of the tread shall be cleaned by a suitable method which removes wax and dirt but does not abrade or permanently change the tread surface. After cleaning, the surface of the tread shall be dried and the caster shall be conditioned at a relative humidity of less than 80 percent for at least 24 hours. Each caster and separate wheel shall be tested while supporting a load equal to 25 percent of its load rating. The caster or separate wheel to be tested shall be rolled onto a clean, dry, flat metal plate. The metal plate and the metal parts of the caster or separate wheel shall form the electrodes for the test. If the caster or separate wheel is tested while supporting equipment, all other casters or separate wheels, under the equipment shall be insulated from the floor on which the metal electrode plate is placed. The resistance between the electrodes shall be measured by any resistance measuring apparatus of suitable range which has an open-circuit direct voltage (d.c.) of approximately 500 volts. For the safety of the operator, the maximum current which can be delivered by the apparatus through a resistance of 500 ohms should be less than 10 milliamperes. Measurements shall be made with five separate areas of the tread successively in contact with the plate, and the average and maximum values shall be determined.

7.6.1 Glides shall be tested in a manner similar to that specified for casters and separate wheels, using a load of 15 pounds, and placing the glide on the metal plate without sliding.

7.6.2 *Sampling and acceptance method for testing electrostatically conductive casters and wheels during manufacture.*

7.6.2.1 *Sample selection.*—Samples for testing shall be taken as follows:

#### (a) Number of pieces:

- (1) Lot size 0 to 100—10 pieces.
- (2) Lot size 100 or more—A number of pieces equal to 10 percent of the total number of pieces in the lot.

#### (b) Dispersion of pieces.

- (1) Pieces shall be chosen at random from each shift's production, with

pieces being obtained from the beginning, middle, and end of each shift's production.

- (2) Each tote box of pieces may be considered an adequate amount to be sample tested.

7.6.2.2. *Procedure for acceptance and rejection.*

- (a) If no defects are found in the initial sampling, the lot shall be considered acceptable.
- (b) If one or more pieces are found to be defective in conductivity, a recheck shall be made of the same lot. This recheck shall consist of an additional sampling according to paragraph 7.6.2.1.
- (c) If the second sampling reveals one or more defective pieces the lot is not acceptable and no piece from the lot shall be accepted unless tested.
- (d) If no defective pieces are found on the second sampling, the lot shall be considered acceptable.

7.7 TEST FOR FINISHES.

7.7.1 *Test for thickness of nickel, cadmium, and zinc coating.*—The thickness shall be determined in accordance with the methods given in applicable specifications of the American Society for Testing Materials, unless otherwise specified.\*

7.7.2 *Salt spray test for continuity of coating.*—The test shall be conducted in accordance with the Method of Salt Spray (Fog) Testing given in applicable specifications of the American Society for Testing Materials, unless otherwise specified.\*

8. LABELING FOR COMPLIANCE

8.1 COMPLIANCE CERTIFICATION.—In order to assure the purchaser that casters, separate wheels, and glides comply with the requirements of this Commercial Standard, it is recommended that manufacturers include the following statement, as applicable, in conjunction with their name and address, on bids, labels, invoices, sales literature, etc.:

- (1) For casters, separate wheels, and glides:

This product\* complies with Commercial Standard CS223-59 as developed by the trade under the procedure of the Commodity Standards Division and issued by the U.S. Department of Commerce.

- (2) For equipment:

This equipment\* is fitted with casters, wheels, or glides, in compliance with Com-

\*Federal specifications and Federal standards are available from the Business Service Center, General Services Administration, Washington 25, D.C. Publications of the American Society for Testing Materials are available from their office at 1916 Race Street, Philadelphia 3, Pa. Lists of publications and prices are available on application.

\*The name of the article (caster, wheel or glide) may be substituted.

\*The name of the equipment (bed, truck, etc.) may be substituted.

mercial Standard CS223-59, as developed by the trade under the procedure of the Commodity Standards Division and issued by the U.S. Department of Commerce.

9. NOTES AND ORDERING DATA

9.1 NOTES ON INTENDED USE.

9.1.1 Casters covered by this standard are intended for use in hospitals and similar establishments. In selecting a caster, consideration should be given to the load to which the individual caster may be subjected. While manufacturers usually publish load ratings, wide differences may exist for similar casters. The load ratings shown in this standard are believed to be conservative and are recommended for use in selecting casters.

9.1.2 For operation on resilient floors, Style 1, 2, and 3 wheels should be used under loads that are suitable for the floor materials on which they will be operated. Such loads, in general, should be substantially less than the load ratings in table 5 in order to protect certain resilient floors from scratches, indentations and marking.

9.1.2.1 The rubber treads specified herein are not of non-floor-marking materials but are such as to produce little or no marking under ordinary conditions. When casters with hard or soft rubber tread wheels are used on types of floor covering such as vinyl plastic, the possibility of staining should be considered. Such staining is avoided by the use of compatible materials in the caster wheels and floor coverings. The manufacturers of these products should be consulted to determine the proper combinations of rubber tread and floor materials to avoid staining. In general, the staining is caused by chemical reaction between lead carbonates, cadmium or copper compounds, or other materials in certain flooring, and rubber compounds in the wheel treads.

9.1.3 When casters operate over rough surfaces such as sharp door sills and other irregularities which cause shocks, wheels should be of sufficiently large diameter to roll easily over obstructions. Wide-face wheels are recommended for use on soft or on rough surfaces. Where quietness of operation is desired, or where shock to and vibration of fragile objects should be held to a minimum, the use of soft tread wheels should be considered. Hard treads should be used for heavy loads.

9.1.4 In areas where certain explosion hazards exist, electrostatically conductive casters should be used. However, it is important that floors in such areas should also be conductive, that other apparatus rests on conductive glides, leg tips, or casters, and that all personnel in the areas wear conductive shoes or the equivalent. A waxed floor may nullify the conductivity characteristics of a caster.



9.2 ORDERING DATA.—In ordering casters, separate wheels, and glides, sufficient information should be given as shown below:

9.2.1 *Casters.*

- (a) Type (swivel or rigid).
- (b) Size, class, wheel style, form of adapter, and finish. (See Table 1 and pars. 3.1.1 to 3.1.6.)
- (c) For Adapters A and N, give inside dimensions of tubing; for Adapter K, give method of attachment for socket. (See pars. 5.4.1, 5.4.2, and 5.4.3.)

The following should be specified when desired:

- (d) Electrostatically conductive casters. (See Table 1 and par. 3.1.5.)
- (e) Wheel brakes. (See Table 1 and par. 5.12.)
- (f) Swivel lock. (See Table 1 and par. 5.13.)
- (g) Thread guards. (See par. 5.14.)
- (h) For Adapter P, bolt hole spacing. (See par. 5.4.4.)
- (j) Inspection requirements. (See par. 7.1.)

9.2.2 *Wheels.*—Orders for separate wheels should give the diameter, class, bore, style, and finish. The following should be given when desired: Electrostatically conductive wheels; thread guards. (See par. 4.1.1.)

9.2.3 *Glides.*—Orders for glides should give the size, the adapter, and finish, and the inside dimensions of tube when tube adapters are specified. The following should be given when desired: Stainless steel glides; electrostatically conductive glides. (See pars. 6.1.1 through 6.5.)

9.3 IDENTIFICATION AND COMPLIANCE.—It is suggested that invitations for bids should request the bidder to state the name of the manufacturer and the manufacturer's model number of the caster, separate wheel, or glide being offered, and also request certification of compliance with this standard. (See par. 8.1.)

# 10. APPLICATION OF CASTERS, WHEELS, AND GLIDES TO EQUIPMENT

10.1 Casters, wheels, and glides covered by this standard are intended to be applied to equipment in conformity with table 6. (See par. 9.1.)

TABLE 6.—Application of casters, wheels, and glides to equipment <sup>1</sup>

Hospital equipment	Caster, wheel, or glide (minimum size and construction)
Bassinets, nursery . . . . .	3" casters with swivel stems.
Bed (not often moved) . . . . .	3" casters with swivel stems.
Bed (mobile unit) . . . . .	5" casters with swivel stems.
Cabinet, instrument . . . . .	Glides.
Cabinet, instrument (operating room) . . . . .	2" casters with swivel stems.
Cabinet, instrument (operating room, mobile) . . . . .	3" casters with swivel stems.
Cabinet, medicine and supply . . . . .	Glides.
Cabinet, miscellaneous . . . . .	Glides.
Cabinet, miscellaneous (mobile) . . . . .	2" casters with swivel stems.
Cabinet, nursery . . . . .	Glides.
Cabinet, nursery (mobile) . . . . .	2" casters with swivel stems.
Cabinet, specialist . . . . .	Glides.
Cabinet, treatment . . . . .	Glides.
Carriage, dressing (light) . . . . .	3" casters with swivel stems.
Carriage, dressing (medium) . . . . .	5" casters with swivel stems.
Carriage, dressing (heavy) . . . . .	8" casters with swivel stems.
Chair, side . . . . .	Glides.
Chair, swivel . . . . .	2" casters with swivel stems.
Conveyor, food . . . . .	8" plate casters; 2 swivel, 2 rigid.
Crib, nursery . . . . .	3" casters with swivel stems.
Desk, chart (ward service) . . . . .	2" casters with swivel stems.
Desk, nurses . . . . .	2" casters with swivel stems.
Dresser . . . . .	2" casters with swivel stems.
Hamper, linen (operating room) . . . . .	2" casters with swivel stems.
Hampers, linen (operating room, heavy) . . . . .	3" casters with swivel stems.
Light, portable, emergency . . . . .	2" casters with swivel stems.
Light, portable, emergency (mobile) . . . . .	3" casters with swivel stems.
Light, portable, spot . . . . .	2" casters with swivel stems.
Light, portable, spot (mobile) . . . . .	3" casters with swivel stems.
Machine, gas . . . . .	3" casters with swivel stems.
Machine, gas (mobile) . . . . .	5" casters with swivel stems.
Rack, bread . . . . .	5" swivel plate casters.
Rack, garment . . . . .	3" casters with swivel stems.

<sup>1</sup> See footnote at end of table, p. 14.

TABLE 6.—Application of casters, wheels, and glides to equipment <sup>1</sup>—Continued

Hospital equipment	Caster, wheel, or glide (minimum size and construction)
Stand, accounting machine . . . . .	2" casters with swivel stems.
Stand, instrument . . . . .	2" casters with swivel stems.
Stand, instrument (mobile) . . . . .	3" casters with swivel stems.
Stand, solution . . . . .	2" casters with swivel stems.
Stand, wall, dressing . . . . .	2" casters with swivel stems.
Stretchers, wheel . . . . .	10" casters with swivel stems.
Table, anesthetics . . . . .	2" casters with swivel stems.
Table, bedside . . . . .	2" casters with swivel stems.
Table, overbed . . . . .	2" casters with swivel stems.
Tent, oxygen . . . . .	3" casters with swivel stems.
Trough, dough . . . . .	5" swivel plate casters.
Truck, canvas bag (steel frame) . . . . .	3" plate casters; 2 swivel, 2 rigid.
Truck, canvas bag (10 bushels and over) . . . . .	5" plate casters; 2 swivel, 2 rigid.
Truck, dish . . . . .	10" wheels (pair) and two 5" swivel plate casters.
Truck, ice . . . . .	8" plate casters; 2 swivel, 2 rigid.
Truck, linen service . . . . .	8" medium-heavy wheels (pair) and two 5" swivel plate casters.
Truck, mopping (pail or bucket) . . . . .	2" casters with swivel stems.
Truck, mopping tank (30 gallon size) . . . . .	8" wheels (pair) and two 5" casters with swivel stems.
Truck, mopping tank (60 gallon size) . . . . .	8" casters with stem; 2 swivel, 2 rigid.
Truck, mopping tank (60 gallon size, heavy) . . . . .	8" wheels (pair) and two 8" casters with swivel stems.
Truck, oxygen tank, 2 wheels . . . . .	8" wheels (pair).
Truck, oxygen tank, 4 wheels . . . . .	8" wheels (pair) and two 3" swivel casters.
Truck, platform . . . . .	5" plate casters; 2 swivel, 2 rigid.
Truck, platform (mobile) . . . . .	5" plate casters; 4 swivel.
Truck, platform (heavy) . . . . .	8" plate casters; 2 swivel, 2 rigid.
Truck, platform (heavy, mobile) . . . . .	8" plate casters; 4 swivel.
Truck, tray . . . . .	8" casters with stem; 2 swivel, 2 rigid.
Truck, tray (mobile) . . . . .	8" casters with swivel stem (four).
Truck, 2 wheel, hand . . . . .	5" wheels (pair).
Truck, 2 wheel, hand (heavy) . . . . .	8" wheels (pair).
Truck, wet wash . . . . .	5" swivel plate casters (four).
Truck, wet wash (heavy) . . . . .	8" plate casters; 2 swivel, 2 rigid.
Truck, wet wash (heavy, mobile) . . . . .	8" plate casters; 4 swivel.

<sup>1</sup> This table conforms to recommendations of the American Hospital Association. Casters, separate wheels, and glides applied to equipment for use in hazardous areas should be electrostatically conductive. Care should

be taken to insure that replacements on such equipment are also electrostatically conductive. (See par. 5.23.)

#### EFFECTIVE DATE

Having met all procedural requirements of the Commodity Standards Division, including approval by the acceptors hereinafter listed, this Commercial Standard was issued by the U.S. Department of Commerce, effective June 15, 1959.

EDWIN W. ELY

*Chief, Commodity Standards Division*

#### HISTORY OF PROJECT

Early interest in standards for casters by the American Hospital Association was later shared by the Caster and Floor Truck Manufacturers' Association in consultations with the Department of Commerce on the establishment of standards for casters and other products in which the two organizations were mutually interested. Certain initial data were obtained in a survey of casters and glides used in the hospital field which was undertaken in 1939 with the assistance of the Committee on Simplification and Standardization of Hospital Furnishings, Supplies, and Equip-

ment of the American Hospital Association, under the guidance of Neal R. Johnson of the Johns Hopkins Hospital in Baltimore, Md.

Tentative uniform specifications were prepared with the assistance of the manufacturers but were delayed because of wartime shortages of needed materials. They were carried forward, however, as conditions permitted, and on March 8, 1946, specifications were submitted by the American Hospital Association to form the basis for a Commercial Standard. A proposed standard was prepared and was circulated to the industry on November 1, 1946, for review and comment. Various modifications were proposed and on May 18, 1949, a joint conference of manufacturers, American Hospital Association, and Government representatives was held at the National Bureau of Standards to consider them. Requirements for conductive rubber and other details were agreed upon, but additional information on load ratings was needed, and the manufacturers accepted an offer by The Firestone Industrial Products Co. to make certain load tests.

Proposals embodying the results of the tests were considered early in 1950, but there was little significant progress during the ensuing defense program. On January 20, 1953, the manufacturers of hospital casters, in a meeting at the Roosevelt Hotel in New York City made effective plans to go forward with the Commercial Standard. A committee under the guidance of W. J. Daugherty of Firestone Industrial Products Co. coordinated further proposals, and with the assistance of Mr. R. J. Benson of the Bassick Co., prepared a proposed standard that was submitted to the manufacturers and the American Hospital Association on September 14, 1954. It was coordinated with new standards for molded rubber wheels being considered by the manufacturers, and with the latest recommendations of the American Hospital Association, but was withheld in June 1956 for the addition of minimum thicknesses for soft rubber tread and other recommendations.

On May 15, 1958, the Recommended Commercial Standard, TS-5385, was submitted to the manufacturers, and with amendments of November 11, 1958, was accepted in writing by the Caster and Floor Truck Manufacturers' Association, and by substantially all producers of the products covered. On January 19, 1959, under the designation TS-5385b, the amended standard was submitted to the American Hospital Association, and representative hospitals and other interests for acceptance. The response was satisfac-

torily representative of the industry as a whole, and the standard was announced on April 30, 1959, as CS223-59, effective from June 15, 1959.

Project Manager: Alfred S. Best, Commodity Standards Division, Office of Technical Services.

Technical Adviser: R. F. Tener, Testing and Specifications Section, Organic and Fibrous Materials Division, National Bureau of Standards.

### STANDING COMMITTEE

The following individuals comprise the membership of the Standing Committee, which is to review, prior to circulation for acceptance, revisions, proposed to keep the standard abreast of progress. Comments concerning the standard and suggestions for revision may be addressed to any member of the committee or to the Commodity Standards Division, Office of Technical Services, U.S. Department of Commerce, which acts as secretary for the committee.

E. M. HEFFERNAN, Jarvis & Jarvis, Inc., South Main St., Palmer, Mass., chairman.

RALPH MOUNT, The Bassick Co., 3045 Fairfield Ave., Bridgeport 5, Conn.

CLARENCE B. NOELTING, Faultless Caster Corp., 1421 N. Garvin St., Evansville 7, Ind.

EUGENE M. DAWSON, 65 S. Front St., Columbus, Ohio. (ROGER C. MELLUM, alternate). Representing the American Hospital Association.

NOTE.—The committee was in the process of formation when the standard was published. The above list gives only the names of those who accepted membership prior to printing. A complete list of the members will be available from the Commodity Standards Division.

## ACCEPTANCE OF COMMERCIAL STANDARD

If an acceptance has not previously been filed, this sheet properly filled in, signed, and returned will provide for the recording of your organization as an acceptor of this Commercial Standard.

Date \_\_\_\_\_

Commodity Standards Division  
Office of Technical Services  
U.S. Department of Commerce  
Washington 25, D.C.

Gentlemen:

We believe that Commercial Standard CS 223-59 constitutes a useful standard of practice, and we individually plan to utilize it as far as practicable in the

production<sup>1</sup>    distribution<sup>1</sup>    use<sup>1</sup>    testing<sup>1</sup>

of casters, wheels, and glides for hospital equipment. We reserve the right to depart from it as we deem advisable.

We understand, of course, that only those products which actually comply with the standard in all respects can be identified or labeled as conforming thereto.

Signature of authorized officer \_\_\_\_\_  
(In ink)

(Kindly typewrite or print the following lines)

Name and title of above officer \_\_\_\_\_

Organization \_\_\_\_\_  
(Fill in exactly as it should be listed)

Street address \_\_\_\_\_

City, zone, and State \_\_\_\_\_

<sup>1</sup> Underscore the one that applies. Please see that separate acceptances are filed for all subsidiary companies and affiliates which should be listed separately as acceptors. In the case of related interests, trade associations, trade papers, etc., desiring to record their general support, the words "General Support" should be added after the signature.

## TO THE ACCEPTOR

The following statements answer the usual questions arising in connection with the acceptance and its significance:

1. **ENFORCEMENT.**—Commercial Standards are commodity specifications voluntarily established by mutual consent of those concerned. They present a common basis of understanding between the producer, distributor, and consumer and should not be confused with any plan of governmental regulation or control. The U.S. Department of Commerce has no regulatory power in the enforcement of their provisions, but since they represent the will of the interested groups as a whole, their provisions through usage soon become established as trade customs, and are made effective through incorporation into sales contracts by means of labels, invoices, and the like.

2. **THE ACCEPTOR'S RESPONSIBILITY.**—The purpose of commercial standards is to establish for specific commodities, nationally recognized grades or consumer criteria, and the benefits therefrom will be measurable in direct proportion to their general recognition and actual use. Instances will occur when it may be necessary to deviate from the standard and the signing of an acceptance does not preclude such departures; however, such signature indicates an intention to follow the commercial standard where practicable in the production, distribution, or consumption of the article in question.

3. **THE DEPARTMENT'S RESPONSIBILITY.**—The major function performed by the Department of Commerce in the voluntary establishment of commercial standards on a nationwide basis is fourfold: First, to act as an unbiased coordinator to bring all interested parties together for the mutually satisfactory adjustment of trade standards; second, to supply such assistance and advice as past experience with similar programs may suggest; third, to canvass and record the extent of acceptance and adherence to the standard on the part of producers, distributors, and users; and fourth, after acceptance, to publish and promulgate the standard for the information and guidance of buyers and sellers of the commodity.

4. **ANNOUNCEMENT AND PROMULGATION.**—When the standard has been endorsed by a satisfactory majority of production or consumption in the absence of active valid opposition, the success of the project is announced. If, however, in the opinion of the standing committee or of the Department of Commerce, the support of any standard is inadequate, the right is reserved to withhold promulgation and publication.

## ACCEPTORS

The organizations listed below have individually accepted this standard for use as far as practicable in the production, distribution, purchase, or use of casters, wheels, and glides for hospital equipment. In accepting this standard they reserve the right to depart from it as they individually deem advisable. It is expected that products which actually comply with the requirements of this standard in all respects will be regularly identified or labeled as conforming thereto, and that purchasers will require such specific evidence of conformity.

### ASSOCIATIONS

(General Support)

American Hospital Association, Chicago, Ill.  
Caster & Floor Truck Manufacturers' Association, Chicago, Ill.

### FIRMS AND OTHER INTERESTS

Adjustable Caster Co., Philadelphia, Pa.  
Aerol Co., Inc., Los Angeles, Calif.  
Albion Industries, Inc., Albion, Mich.  
Allegheny General Hospital, Pittsburgh, Pa.  
Allentown General Hospital, Allentown, Pa.  
American Hard Rubber Co., Putler, N.J.  
Anderson Memorial Hospital, Anderson, S.C.  
Arnot-Ogden Memorial Hospital, Elmira, N.Y.  
Bassick Co., Bridgeport, Conn.  
Baylor University Hospital, Dallas, Tex.  
Benjamin Franklin Hospital, Columbus, Ohio.  
Beth Israel Hospital, Boston, Mass.  
Beth Israel Hospital, New York, N.Y.  
Bluefield Sanitarium, Bluefield, W. Va.  
Boston Lying-in Hospital, Boston, Mass.  
Broadlawn Hospital, Des Moines, Iowa.  
Bryn Mawr Hospital, Bryn Mawr, Pa.  
Burlington County Hospital, Mt. Holly, N.J.  
Burlington Hospital, Burlington, Iowa.  
Caledonian Hospital, Brooklyn, N.Y.  
Central Islip State Hospital, Central Islip, N.Y.  
Central Maine Sanatorium, Fairfield, Maine.  
Children's Hospital, Inc., St. Paul, Minn.  
Children's Hospital of Pittsburgh, Pittsburgh, Pa.  
Children's Orthopedic Hospital, Seattle, Wash.  
City of Cincinnati General Hospital, Cincinnati, Ohio.  
Cleveland Clinic Foundation, Cleveland, Ohio.  
Coaldale State Hospital, Coaldale, Pa.  
Colson Corp., Jonesboro, Ark.  
Columbia Hospital, Milwaukee, Wis.  
Commonwealth of Massachusetts, Worcester State Hospital, Worcester, Mass.  
Community Hospital, Kane, Pa.  
Community Hospital Association, Battle Creek, Mich.  
Creighton Memorial Saint Joseph's Hospital, Omaha, Nebr.  
Darnell Corp., Ltd., Downey, Calif.  
Dunham Hospital, Cincinnati, Ohio.  
Dudwallen Manufacturing Co., Inc., East Hartford, Conn.  
Elizabeth Steel Magee Hospital, Pittsburgh, Pa.  
Episcopal Hospital, Philadelphia, Pa.  
Fairbanks Co., New York, N.Y.  
Faultless Caster Corp., Evansville, Ind.  
Firestone Industrial Products Co., Noblesville, Ind.  
Firestone Rubber & Latex Products Co., Fall River, Mass.  
Franklin County Public Hospital, Greenfield, Mass.  
Freedmen's Hospital, Washington, D.C.  
Geneva Metal Wheel Co., Geneva, Ohio.  
Clark, George P., Co., Windsor Locks, Conn.  
George Washington University, Washington, D.C.  
Glendale Sanitarium & Hospital, Glendale, Calif.  
Grace-New Haven Community Hospital, New Haven, Conn.  
Grandview Hospital, La Crosse, Wis.  
Hackley Hospital, Muskegon, Mich.  
Hahnemann Hospital, Washington, D.C.  
Hamilton Caster & Manufacturing Co., Hamilton, Ohio.  
Hamot Hospital, Erie, Pa.  
Harris & Reed Manufacturing Co., Chicago, Ill.  
Harris Hospital, Fort Worth, Texas.  
High Point Memorial Hospital, High Point, N.C.  
Holy Name of Jesus Hospital, Gadsden, Ala.  
Hospital for Crippled Children, Newark, N.J.  
Huntington Hospital, Huntington, N.Y.  
Iowa Methodist Hospital, Des Moines, Iowa.  
Jarvis & Jarvis, Inc., Palmer, Mass.  
John D. Archbold Memorial Hospital, Thomasville, Ga.  
Kennestone Hospital, Marietta, Ga.  
Lake County Memorial Hospital, Palmyra, Ohio.  
Lakeville State Sanatorium, Middleboro, Mass.  
Lakewood Hospital, Lakewood, Ohio.  
Loma Linda Sanitarium & Hospital, Loma Linda, Calif.  
Louisville General Hospital, Louisville, Ky.  
Lutheran Hospital Society of Southern California, Los Angeles, Calif.  
MacNeal Memorial Hospital, Berwyn, Ill.  
Memorial Hospital, Wilmington, Del.  
Mercy Hospital, Bakersfield, Calif.  
Mercy Hospital, Urbana, Ill.  
Mercy Hospital, Portland, Maine  
Mercy Hospital, Hamilton, Ohio.  
Mercy Hospital—Street Memorial, Vicksburg, Miss.  
Middle River Sanatorium & Douglas County General Hospital, Hawthorne, Wis.  
Middletown Hospital Association, Middletown, Ohio.  
Middletown State Homeopathic Hospital, Middletown, N.Y.  
Midland Truck, Caster & Wheel Co., Irvington, N.J.  
Milwaukee County Hospital, Milwaukee, Wis.  
Montefiore Hospital, Bronx, N.Y.  
Moose Lake State Hospital, Moose Lake, Minn.  
Mount Auburn Hospital, Cambridge, Mass.  
Mount Sinai Hospital, Hartford, Conn.  
Myer's Truck & Caster Co., Nashville, Tenn.  
Nagel-Chase Manufacturing Co., Chicago, Ill.  
Nanticoke State Hospital, Nanticoke, Pa.  
Nebraska Hospital for the Tuberculous, Kearney, Nebraska.  
New England Peabody Home for Crippled Children, Newton Center, Mass.  
New Mount Sinai Hospital, Toronto, Ontario, Canada.  
New York State Psychiatric Institute, New York, N.Y.  
Newman Memorial County Hospital, Emporia, Kans.  
Norristown State Hospital, Norristown, Pa.  
Northwestern Hospital, Minneapolis, Minn.  
Norwalk Hospital, Norwalk, Conn.  
Oak Ridge Hospital, Oak Ridge, Tenn.  
Orange Memorial Hospital, Orange, N.J.  
Paterson General Hospital, Paterson, N.J.  
Payson Manufacturing Co., Chicago, Ill.  
Pittsfield General Hospital, Pittsfield, Mass.  
Presbyterian Hospital Unit of the United Hospitals of Newark, N.J.  
Provident Hospital & Training School, Chicago, Ill.  
Quincy City Hospital, Quincy, Mass.  
Rapid-Standard Co., Inc., Grand Rapids, Mich.  
Rex Hospital, Raleigh, N.C.  
Riverside Hospital, Newport News, Va.  
Rochester Methodist Hospital, Rochester, Minn.  
Roosevelt Hospital, New York, N.Y.  
Saginaw General Hospital, Saginaw, Mich.  
Saginaw Products Corp., Saginaw, Mich.  
St. Anthony Hospital, Denver, Colo.  
St. Elizabeth Hospital, Granite City, Ill.  
St. Francis Hospital, Hartford, Conn.  
St. Francis Xavier Hospital, Charleston, S.C.  
St. John's Episcopal Hospital, Brooklyn, N.Y.  
St. Joseph Hospital, Albuquerque, N. Mex.  
St. Joseph's Hospital, Phoenix, Ariz.  
St. Joseph's Hospital, Elmira, N.Y.  
St. Luke's Hospital, New Bedford, Mass.  
St. Luke's Methodist Hospital, Cedar Rapids, Iowa.  
St. Mary's Hospital, Minneapolis, Minn.  
St. Mary's Hospital, Superior, Wis.  
St. Therese's Hospital, Waukegan, Ill.  
Scott & White Memorial Hospital, Temple, Tex.  
Seattle General Hospital, Seattle, Wash.  
Silver Cross Hospital, Joliet, Ill.  
South Nassau Communities Hospital, Oceanside, L.I., N.Y.  
Southern Baptist Hospital, New Orleans, La.  
Spencer State Hospital, Spencer, W. Va.  
State Hospital, Jamestown, N. Dak.  
State University of Iowa Hospitals, Iowa City, Iowa.  
Strong Memorial Hospital, Rochester, N.Y.  
Suburban Hospital Association, Bethesda, Md.  
Sunny Acres Cuyahoga County Tuberculosis Hospital, Cleveland, Ohio.  
Taunton State Hospital, Taunton, Mass.  
Toledo Hospital, Toledo, Ohio.  
Thomas Truck & Caster Co., Keokuk, Iowa.  
Trinity Hospital, Detroit, Mich.  
Trumbull Memorial Hospital, Warren, Ohio.  
University of Chicago, Medical Group, Chicago, Ill.  
University Hospitals, Madison, Wis.  
Valley Memorial Hospital, Sunnyside, Wash.  
Vancouver Memorial Hospital, Inc., Vancouver, Wash.  
Virginia Mason Hospital, Seattle, Wash.  
Waterbury Hospital Inc., Waterbury, Conn.  
Watts Hospital, Durham, N.C.  
Wesson Memorial Hospital, Springfield, Mass.  
West Jersey Hospital, Camden, N.J.  
Western State Hospital, Fort Steilacoom, Wash.  
Williamsport Hospital, Williamsport, Pa.  
Wing Memorial Hospital, Palmer, Mass.

### U.S. GOVERNMENT

Department of the Army.  
Veterans Administration.

### OTHER COMMERCIAL STANDARDS

A list of Commercial Standards may be obtained from the Commodity Standards Division, Office of Technical Services, U.S. Department of Commerce, Washington 25, D.C. This list includes the purchase price of each publication and gives directions for ordering copies.